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GEOPHYSICAL VARIABLES AND BEHAVIOR: XXXII. EVALUATIONS OF UFO REPORTS IN AN AREA OF INFREQUENT SEISMICITY: THE CARMAN, MANITOBA EPISODE

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Summary.—A critical test of the observation that most well documented episodes ("flaps") of UFO reports (UFORs) display a temporal relationship to the nearest release of seismic energy was completed for the Carman episode. These reports occurred over a 3-yr. period (1974-1977) near Winnipeg, Manitoba; yet, this province has no recorded seismicity. Visual inspection of the numbers of UFORs per month during this period indicated they were strongly correlated with the amount of seismic energy released within 1000 km. The Carman episode occurred during the time of the closest and strongest recorded earthquake in the recent history (since 1950) of the area. Characteristics of the local geology and crustal morphology were considered as factors that might influence the furthest distance at which seismicity is associated with UFORs. The results were interpreted as supporting the hypothesis that most well documented episodes of UFORs refer to actual geophysical phenomena that are generated by tectonic strain.

One frequent criterion for the test of an hypothesis is to determine situations in which it might be refuted. The tectonic strain hypothesis for luminous phenomena (LP) asserts that many reports of classic UFOs (unidentified flying objects) represent actual geophysical phenomena. Classic reports involve descriptions of unusual spherical or ovoid, primarily reddish, white, or multicolored lights that display erratic or unusual movements. They are expected to be coupled in time to the release of seismic energy (Persinger, 1976; 1984a; Persinger & Derr, 1984) because both phenomena are generated by tectonic strain. However, the labels and hence the perceptions and descriptions of luminous phenomena have changed from generation to generation (Persinger, 1984b).

Several multivariate studies have indicated that UFO reports tend to precede increases in earthquake activity within a region by several months (Persinger, 1980; Persinger & Derr, 1984). Rutkowski (1984) has argued that these analyses involved undifferentiated reports that were collected over large areas and within wide time frames. More recent analyses (Persinger & Derr, 1984) indicated that the numbers of luminous phenomena (specifically) were associated with the numbers of earthquakes per month in Washington state.

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In addition, a well documented "UFO flap", involving primarily luminous phenomena within the Uinta Basin showed a strong temporal correlation between the numbers of reports of luminous phenomena per month and the earthquake activity per month within 150 km (but not between 150 to 250 km) from the small area within which the phenomena were reported (Persinger & Derr, 1985).

Another study (Derr & Persinger, 1985) that involved systematic observation of luminous pehnomena by fire lookouts in the Yakima area in Washington state showed that these phenomena were correlated in time with earthquake activity within 100 km of the observations but not with seismic activity between 100 and 200 km away. A relatively large correlation was found between the change in the number of earthquakes per month from the previous month and the numbers of luminous phenomena for the primary observation period of 60 months. These reports originated primarily above a segment that was not geologically distinct from about 50 other folds in the area except that it was still undergoing substantial tectonic strain.

To date, most of the areas that have been analyzed have involved both earthquake and UFORs within the same general area ($r \leq 250$ km). However, a classic UFO "flap" occurred around Winnipeg, Manitoba during the years 1974 through 1977 (Rutkowski, 1983). Historically, Manitoba has shown no recorded earthquake activity although seismicity surrounds the province. This area and period seemed appropriate to attempt to refute the hypothesis.

We decided to determine if the numbers of UFO reports from the Rutkowski database varied systematically over time with seismicity. To obtain a sufficient but tractable number of detected seismic events during the 1974-1977 period, we had to expand our circle search (HDF data base from the U.S.G.S.) to a radius of 1000 km from Winnipeg. To give historical perspective, all earthquakes since 1950 were determined. We did not expand the area further because at about 1250 km from Winnipeg, seismic activity from the very active Yellowstone area is encountered. Although the radius for the inclusion of seismic events was about five times larger than we have usually employed, we explain below why we hypothesized that the release of seismic energy over time within this region should be correlated with the numbers of UFORs.

The UFO data were obtained directly from Table 6 of Rutkowski's analyses of the Manitoba UFO Catalogue (Rutkowski, 1983)[3] from July 1974 through April 1977. Most of these reports ($n = 215$) originated within 100 km of Winnipeg, although the greatest concentration occurred in an area to the west of the city (and the Red River) and to the south of the Assiniboine River. A

[3]Thanks are due Chris Rutkowski for the data and for his constructive criticisms. Both have helped develop and refine the tectonic strain hypothesis for luminosities.

significant cluster of UFORs occurred in the vicinity of Carman, Manitoba (the "Carman flap").

Rutkowski concluded that the 1974-1977 period displayed the characteristics of a classic UFO flap. Most (70%) of the reports involved nocturnal lights that displayed unusual kinetics; the most frequent colors were red, white, and orange. There were close encounter experiences where the observer reported a degree of strangeness or more elaborate detail of the phenomenon. Less than 10% of the reports involved day-light observations of silver- or black-looking phenomena. These types and proportions of reports are similar to other classic UFO flaps (Salisbury, 1974).

Specific analyses of 34 cases by Rutkowski within the Carman area indicated that 80% of the cases involved the observation of strange (nocturnal) red lights. In addition, during the years 1975-1976 hundreds of witnesses reported "Charlie Redstar", a bright bobbing ball of red, orange, or white light within an area between Carman and Sperling, Manitoba. The loci of the observations composed an elliptical-shaped region that was oriented in a southwest northeast direction with the major axis passing through Winnipeg. Sperling was also the main location for a second type of nocturnal light; these phenomena seemed to "dance", then flare up and either disappear or "fly away".

Since the UFO reports were tabulated in numbers per month, we calculated the total sum of the seismic energy release per month by the formula $E = 10^{(2.4^m+5.8)}$ where m is the magnitude (mb) of the seismic event. If a magnitude was not given for a seismic event on the record, a value of 3.0 was allocated because this was an expected threshold level for this period within this region.

The distribution of earthquake epicenters within 1000 km of Winnipeg for the years 1964 through 1984 are shown in Fig. 1. For comparison, the locations of the seismic events that occurred during the study period are indicated by closed circles. The large circles (open and closed) designate the large seismic events ($mb \geqq 5.0$). As can be seen most of the recorded seismicity around Winnipeg occurred to the south and west. The total number of seismic events during the Carman episode was 17, compared to a total of nine events for the 34-mo. period before and 12 events for the 34 mo. afterwards. A oneway analysis of variance indicated that there was no significant ($p > .05$) difference in the mean distances of epicenters for the three 34-mo. periods ($F = 1.46$, $df = 2/32$).

Fig. 1 indicates that an unusually strong seismic event ($mb \geqq 5.0$) occurred in western Minnesota near the beginning of the Red River. This event occurred in July, 1975 and was within 500 km of Carman. Both the occurrence and the strength of the earthquake were very unusual for the area. Only four other seismic events with $mb \geqq 5.0$ occurred within the recorded history of the area; they occurred on 28 March, 1964, 30 October, 1968, 29 May, 1984,

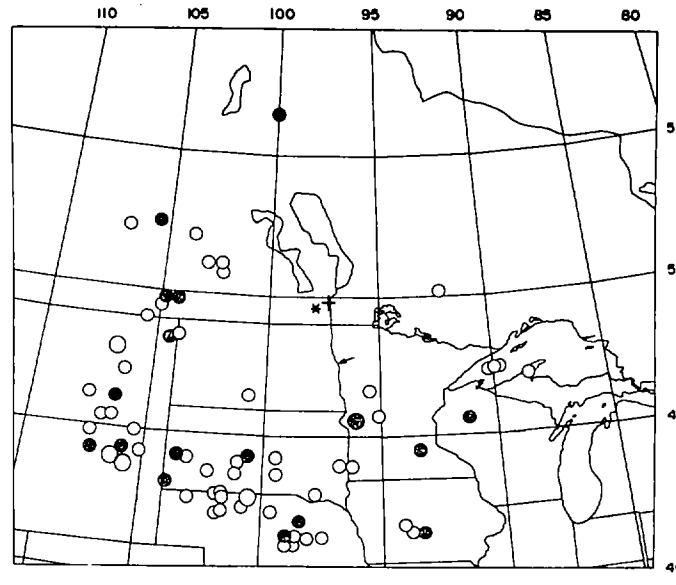

FIG. 1. Distribution of earthquake epicenters within 1000 km of Winnipeg (the plus) from the years 1964 through 1984. Epicenters of earthquakes that occurred during the three years of the Carman episode are indicated by closed circles. The strongest earthquakes ($mb \geq 5.0$) are indicated by larger circles (open and closed). Note the occurrence of the large seismic event in Minnesota that occurred within 500 km of Carman (asterisk). The arrow indicates the (northern) Red River; it begins in southern Minnesota-North Dakota passes through Winnipeg and ends in Lake Winnipeg.

and 8 September, 1984. However, only the May, 1975 event was within 500 km. All of the other four large quakes occurred at distances greater than 750 km (but less than 1000 km) from Winnipeg.

Fig. 2 shows the relationship over time between the numbers of reports of UFO phenomena per month during the Carman episode and the amount of seismic energy released per month during the same period. Visually, the relationship is quite clear. The largest numbers of UFORs occurred during the two months before the largest and closest release (July, 1975) of seismic energy in the recent history (since 1950) of the area. The second major display of UFORs occurred two months before the second largest release of seismic energy (September, 1976) for that period.

The smaller releases of energy were temporally contiguous with the numbers of UFORs, although they occurred within one month of the seismic activity. A relationship between the magnitude of the energy release and the displacement in time (lag) of UFORs has been reported elsewhere (Persinger & Derr, 1984). We suspect that maintained elevation of UFORs after July, 1975 was associated with the seismic release on October, 1975.

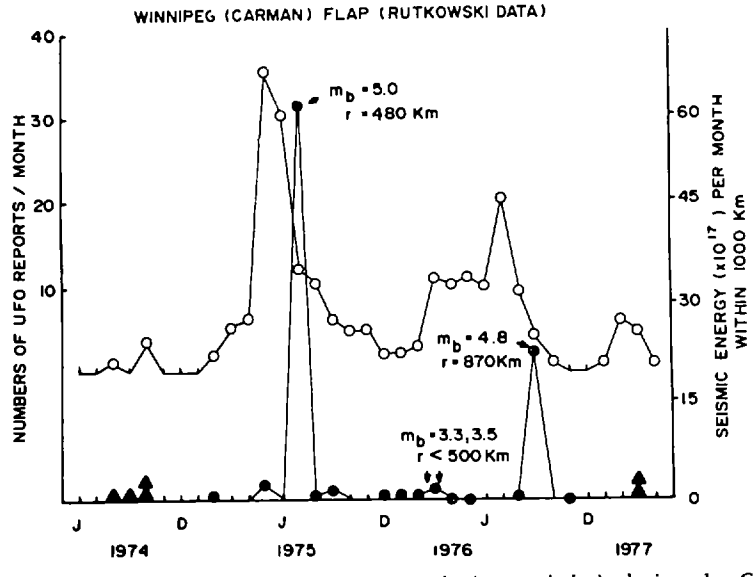

FIG. 2. Numbers of UFO reports per month (open circles) during the Carman episode from June, 1974 through April, 1977. The magnitudes of the sum of the seismic energy release per month (solid circles) within 1000 km of Winnipeg are also shown. The two strongest seismic events and their distances from Carman are noted. The occurrence of two $mb \geqq 3.0$ events in March, 1976 is also indicated. The seismic event in July, 1975 was the closest and strongest earthquake in recorded history for the Winnipeg area. The occurrences of only the strongest quakes ($mb \geqq 3.0$) along the outside of the perimeter (between 1000 km and 1250 km from Winnipeg) are indicated by solid triangles.

Quite obviously, there was no detectable seismic activity within 1000 km of Winnipeg during the display of a few UFORs during October, 1974 and March, 1977. Since it was possible that some very powerful seismic events along the perimeter of the area may have contributed to these reports, all of the strongest events ($mb \geqq 3.0$) that occurred between 1000 km and 1250 km from Winnipeg were determined. Beyond 1250 km from Winnipeg, the more active seismic zones of the Yellowstone area are encountered. As can be seen in Fig. 2, these events (indicated by closed triangles) occurred *only* during the same months as the smaller displays of UFORs. Two seismic events (in one month) occurred in October, 1974 ($mb = 3.0, 4.6$) and March, 1977 ($mb = 3.0, 3.5$).

On the basis of these patterns, we concluded that the temporal distribution of seismic events within 1250 km of Winnipeg and the occurrence of UFORs during the 34 mo. that constituted the Carman episode indicate the two phenomena are related. Unlike previous studies, however, the most relevant (recorded) seismicity appeared to have occurred between 500 km to 1000 km

from Winnipeg. There were no detectable events within 100 km of Winnipeg or Carman, although small magnitude events ($mb \leq 2.0$) may have occurred.

In our previous work, UFORs were most correlated with seismicity within 150 km of the area within which the UFORs occurred (Persinger & Derr, 1985). In this study, however, the spatial parameters involved with the optimal distances are much larger. We would expect the differences to be a function of the geology or tectonics. The other study areas were in Washington state and Utah. These areas are a part of the western US which is characterized by a large number of accreted terrains, a conglomeration of little pieces of plates from diverse sources. Earthquake areas contain active faults which generally prevent stress from propagating across them.

On the other hand, the central plains area, which includes Winnipeg and the states to the south, is part of a much older, homogeneous central plate or shield. Stress is more coherent over the large area of the central US-Canadian shield than in much smaller areas in the seismically-active western US. The fact that any earthquake is felt over vastly greater areas of the central and eastern US and Canada, as compared to the same magnitude quake in the western parts, is another consequence of this very situation. Our hypothesis is that strain within high-seismicity areas such as the Uinta Basin or the Yakima fold region is usually maintained within discrete boundaries whose diameters may be no more than 200 to 300 km, whereas strain within field areas such as the Winnipeg region would be coherent over much larger distances.

A possible contributor to stress within the latter region might be changes in the Red River System. The Red River (of the North) is formed by the confluence of Bois de Sioux and Otter Tail Rivers at the twin cities of Wahpeton, North Dakota, and Breckenridge, Minnesota. (The July, 1975 earthquake occurred less than 100 km to the southeast of Breckenridge.) The Red River flows northward, forming the North Dakota-Minnesota border before entering Manitoba where it empties into Lake Winnipeg. Since the 1960s, the level of the lake has been controlled for water resources.

According to the tectonic strain hypothesis, combinations of far-field stresses and local loads, such as protracted elevations of water levels in the Lake Winnipeg or particularly high river levels, could precipitate the occurrence of luminous phenomena. Changes in the level of water in reservoirs have been shown to influence local seismicity, particularly if the area is under substantial deformation. Interestingly, it is not unusual for luminous phenomena to be reported near small reservoirs or lakes following unusual changes in their volumes.

Previous criticisms by Rutkowski (1984) have indicated that UFORs have not been attributed to specific seismic events. Whereas some previous studies have emphasized clusters of seismic events when dealing with UFORs that were collected over large areas, there is some evidence that specific seismic

events may be associated with multiple numbers of UFORs within a few days or weeks (a "flap"). In the present study, the two largest displays of UFORs occurred just before the two strongest single seismic events of the period.

What is still not clear, however, is how these UFO phenomena are generated by the conditions that ultimately produce an earthquake hundreds of kilometers away. According to our hypothesis about tectonic strain, strain fields move through coherent geological areas as local and far-field stresses change. In some susceptible areas, these strain fields generate phenomena that are labelled or perceived as luminous phenomena or "UFOs". Although the results of the present study demonstrate another temporal relationship between UFORs and the occurrence of earthquakes, there is still no direct evidence to support the existence of dynamic strain fields.

What geological features predisposed the Winnipeg-Carman area to be more susceptible to the generation of luminous phenomena compared to other areas along the Red River? Or, were the phenomena present but not reported in other areas during this period? Since UFORs tended to occur weeks to two months before the release of seismic energy (through $mb \geqq 3.0$ events), are there specific stages in the processes of strain development (before an earthquake) that generate luminous phenomena? Or, alternatively, are these phenomena associated with clusters of small magnitude events, now below detection threshold, that also precede the major events by weeks to months? If dynamic, moving strain fields exist, their physical properties and the characteristics of the local geology should answer these questions.

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